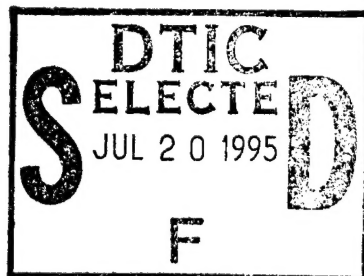# NAVAL POSTGRADUATE SCHOOL
Monterey, California

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PRICE DEFLATORS IN MAINLAND CHINA

by

Chih-Ping Shih

March, 1995

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This thesis applies the theory of price indexes to the analysis of price changes in the People's Republic of China. Economic and political trends that may have contributed to the extreme inflation in China in the lates 1980s are examined. The theory of price indexes is discussed. Several regression models are constructed to examine the relationship between inflation and several other measured economic factors in China. The model results indicate a relationship between the categories of economic goods and the price index. No similar relationships exist between coastal versus interior region or output/income level and the price level. Food was the economic category most strongly associated with the increases in price. This suggests that increases in the price of food are a major cause of inflation in China.

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PRICE DEFLATORS IN MAINLAND CHINA

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ABSTRACT

This thesis applies the theory of price indexes to the analysis of price changes in the People's Republic of China. Economic and political trends that may have contributed to the extreme inflation in China in the lates 1980s are examined. The theory of price indexes is discussed. Several regression models are constructed to examine the relationship between inflation and several other measured economic factors in China. The model results indicate a relationship between the categories of economic goods and the price index. No similar relationships exist between coastal versus interior region or output/income level and the price level. Food was the economic category most strongly associated with the increases in price. This suggests that increases in the price of food are a major cause of inflation in China.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The People's Republic of China experienced extreme levels of inflation in the late 1980s. For most of the history of communist China, inflation has been avoided. Inflation co-exists, however, with some of the major events in modern Chinese history. In the late 1940's, and again in the 1960's, China experienced heavy inflation that coincided with periods of political and societal crisis. As a result, the communist leadership has focused for many years upon controlling the level of inflation through rigid economic control at all levels.

More recently, the Chinese leadership have decided to liberalize the economy of China, moving toward a free market system. The movement from tightly controlled economies, such as those in the former Warsaw Pact nations, to less regulated, western-style economies is typically marked by steep inflationary trends. While this is the case for China, its dependence on farmers' markets to move food to its enormous and widely dispersed population has lessened the presence of inflation in the economy as a whole. This was not the case in the late 1980s, however, when panic-buying sparked already existing modest price increases into higher levels of inflation. The period of high inflation may have been related to the political crisis that lead, ultimately, to the events in Tinanmen Square in 1989.

China is striking in its economic, geographic, and social diversity. The aim of this thesis was to apply the theory of price indexes to the anlysis of price changes in China. Several regression models were constructed to examine the relationship between

inflation and several other measured economic factors at work in China. The relationships examined included that between the categories of economic goods and the price index, coastal versus interior geographic location and the price index, and ouput value and the price index. The model results indicate that a significant relationship exists only between the categories of economic goods and the price index. Food was the economic category most strongly associated with the increases in price. This suggests that increases in the price of food are a major cause of inflation in China. The other factors examined do not have a significant relationship with inflation.

I. INTRODUCTION

Since the return of Deng Xiaoping to power in 1978, China has entered a new era. Deng and his fellow leaders invited foreign businesses to enter into joint ventures and other forms of cooperative production with Chinese industries, in an effort to revive and modernize the Chinese economy. At the present time China is the fastest growing economy in the world, with growth averaging approximately 9 percent per annum.[1] China's real Gross Nation Product (GNP) increased by 13.4 percent in 1993.[2] However, escalating inflation has threatened economic growth. China's cost-of-living index indicated that urban inflation increased by 23.9 percent during 1993, nearly twice that of the 1992 level. The post-Deng era will face many uncertainties and challenges, particularly in the development gap between Mainland China's coastal areas and interior hinterland.

This study is intended to apply the theory of price indexes to the analysis of price changes in Mainland China's non-defense sectors. In Chapter II, I will investigate the historical background of inflation and economic growth in Mainland China. Chapter III will review the theory of price indexes. Chapter IV will apply a multiple regression model in different areas and categories to estimate the relationship of these factors to the price of different commodities. Chapter V concerns price deflators in China. Chapter VI presents conclusions and recommendations.

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[1] Bell, M., Khor, H., and Kochhar, K., *China at Threshold of a Market Economy*, International Monetary Fund, September, 1993.
[2] *China's Economy in 1993 and 1994: The Search for a Soft Landing*, Central Intelligence Agency, 22 July 1994.

II. THE DEFINITION OF INFLATION

Inflation is the result of a more rapid increase in the amount of money and credit in circulation than in the supply of goods available for purchase. It has been said, inflation is the result of "too many dollars chasing too few goods". When inflation occurs, there is a rise in the price level. Usually inflation is defined as a continuous upward rise in the general price level, as measured by one of the price indices. In some circumstances, it is defined according to its cause, such as demand inflation, cost inflation or expectation inflation. Inflation can be defined as a highly erratic successive rise in the general price level, the social and economic consequences of which might have a damaging effect on the economic development and the long-run general welfare of the economy. A mild and slow rate of inflation, it is sometimes argued, enhances the process of economic development by mobilizing economic resources and providing for more investment opportunities. A high rate of inflation is not generally recommended on any grounds. Inflation, no doubt, has both social and economic costs and benefits; however a sufficiently high rate of inflation will guarantee that costs outweigh benefits. Moreover, when inflation proceeds at an expected rate, various means to avoid its cost may exist. If, for instance, inflation is proceeding at an average rate of 15 percent per year, accounting for such an increase can be made in economic and social contracts and plans. It is in this sense that our concern is mainly with unanticipated and erratic rates in the increase of the general price level. Finally, inflation, while it can be seen as enhancing the process of economic development, might have long-tern welfare costs in the form of widening the

gap between the rich and poor, and the resultant distortion and misallocation of resources that such an event would encourage.

It is for this reason that the national price level must be under the control of monetary authorities. Usually inflation occurs when the volume of currency issued exceeds what is actually required by commodity circulation. From the perspective of social reproduction, it is an economic phenomenon involving currency depreciation that occurs when the growth of the money supply exceeds the level required by the growth of total demand. The key to understanding inflation is that the growth of money supply is in excess of demand, to the extent that currency stability indicates whether or not the money supply has expanded beyond demand.[3] Therefore, in order to have full control over inflation, the monetary authorities must identify its cause. This is the core dilemma of the inflation problem. Once the cause is identified the treatment becomes much easier. Inflation has many causes. Inflation can be demand-pull in nature; this type can be caused by either monetary or fiscal policy or both. Inflation can be aggregate; however, it can conversely be sectoral. Inflation can be cost-push, which may derive from profit inflation or wage inflation. Inflation can be a result of temporary causes, such as inflation due to war or a bad harvest; fortunately, these are easily identified. Inflation can also be a result of external circumstances, such as that transmitted to the domestic economy in the form of higher prices for goods and services imported from abroad.

Identifying the cause of inflation is further complicated by interactions between its causes. Inflation can, for instance, originate as demand inflation, but be sustained by

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[3] Colander, David, C., *Macroeconomics*, Irwin, 1993.

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cost inflation. In the case of such an interaction, the problem becomes one of determining which factor is the cause and which is the effect.

1. Demand-Pull Inflation

The demand-pull theory asserts that the presence of excess aggregate monetary demand pulls up prices. This occurs when the rate of growth of the money supply and its associated demand exceeds the rate of growth in national output. This was originally referred to as the quantity theory, which assumes that the change in price level is proportionate to the change in the nominal money supply. The demand-pull theory is expressed in the Keynesian framework, defined as aggregate monetary demand exceeding the aggregate supply of goods and services. That is, the total amount of consumption plus investment plus government expenditures $(C + I + G)$ is greater than the available resources at current prices. When one of these three sectors tries to increase its share of the available resources, after meeting with resistance from the other sectors, the other sectors shares may decline. Pressure, in this case, is put on the existing resources, and prices, therefore, are driven up. The increase in price level may be a short-run phenomenon which occurs when supply does not responds fast enough to the increased demand. In this case inflation is halted when supply expands in accordance with increased demand. If the economy is operating at full capacity, on the other hand, the problem becomes more long term.[4]

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[4] Ibid.

2.   Cost-Push Inflation

Cost inflation is caused by increased demand in the labor market. If wages are determined by the interaction of demand for and supply of labor, given that free competition is prevailing in the labor market, and if a situation of excess demand for labor develops, wages will be driven up. Wages may also increase, even if an excess demand for labor does not exist. In this situation, it is assumed that labor, as a result of the increase in the price of commodities initiated by excess demand, will demand and get an increase in wages. These increases in wages, if passed to the consumer in the form of higher prices, will cause an upward wage and price spiral to develop. On the other hand, part of the higher income of the wage earners and the higher profits to the owners will be translated into higher demand and another round of demand pull inflation would take place, depending on the size of marginal propensities to consume and invest.

The main criticism directed toward the demand pull theory is its inability to explain the rise in prices and wages even in the face of excess capacity and high unemployment. To overcome this shortcoming of the demand-pull theory, the cost-push theory of inflation emerged on the supply side. This theory refers related to a situation in which costs increase faster than productivity. The increased cost is assumed to be independent of the state of excess demand. Hence, there is an autonomous increase in cost even if excess demand does not exist. Such an increase in costs is attributed to two factors: (a) a rise in wages, or (b) a rise in profits.[5]

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[5] Ibid.

Wage inflation has traditionally been blamed on labor unions, which attempted to raise their share of the national income. It is assumed that unions demand a rise in their nominal wages in order to keep the real wages of their members unaffected by the rising cost of living. Therefore, a demand for higher wages takes place even if excess demand for labor does not exist. Such increases in the nominal wage, if obtained, will necessarily lead to increases in costs. If such cost increases are passed on to the consumer, higher prices result. The increase in prices may lead to another round of demand, and another increase in wages. Thus an upward wage/price spiral will develop. Two things may occur as a result. First, the money supply has to increase to maintain a higher level of employment. In this case the role of the money supply is passive; the money supply is the only a mechanism by which the increase in wages and prices are maintained. Second, a successive wages/price spiral will result in decreased profits and hence reductions in production, and developing unemployment. It is assumed that labor unions have more bargaining power in periods of business prosperity. In periods of high profits, labor unions become more powerful and may use either the threat of a strike or an actual strike if their demands are not met. Businesses, when prospering, on the other hand, weaken in the face of strikes, while its ability to grant higher wages out of the higher profits increases.[6] Profit inflation comes about when management tries to secure higher rates of profit, thereby widening their profit margin and leading to higher price levels. A wage

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[6] Rousseau, Stephen, Ed., *Inflation: Its Causes, Consequences, and Control*, Syposium held by the Department of Economics of New York University, Juanuary 31, 1968.

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price spiral may follow. On the other hand, the increased profit or increases in wages may lead to demand-pull inflation.

The interaction between the two theories should be clear from the analysis above. Both demand-pull and cost-push inflation can be the cause as well as the effect of each other. Inflation can originate with demand pull, but be propagated by a cost mechanism. Conversely, inflation can originate with cost push and be propagated by demand mechanism. For a policy to be effective, it is necessary to determine which mechanism is the cause and which is the effect. That is, it is necessary to determine whether demand-pull was initial cause of the inflation spiral, with cost-push merely caused by the reaction of different variables to that spiral.

Theorists point to the increase in costs which precede the increase in prices to support the cost-push theory. When the opposite situation occurs, that is, when price increases precede a cost increase, demand-pull inflation is said to be present. However, no one knows whether prices rise first or costs rise first. No one knows where the first ends and the second begins. Moreover, effects can precede causes: when wages are expected to rise, prices may move up, building on such expectations. In addition, the temporal relation between wages and price might be distorted when prices and wages start undulating through the economy. The argument that wages rise faster than productivity, in support of the cost-push theory, proves nothing about the source of inflation. Money wages can rise faster than productivity in a sustained price rise, independent of its cause. This can occur even in the case of pure demand-pull inflation. In addition, the same argument can be advanced in support of the demand-pull theory, as

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long as expenditures in money terms rise faster than productivity. Moreover, when total expenditures exceed total available resources, prices will rise, but this by itself is not evidence of the source and cause of inflation.

3. Expectation Inflation

Prices and wages rise if people expect that such a rise will take place. Apart from the labor unions, and the excess demand for labor in a competitive market, wage push inflation can take place if labor expects the price level to rise or to keep rising. Labor will, when the price level is rising or is expected to rise, move to protect their wages from declining in real terms. In general, labor will incorporate into their wage demands the expected increase in the price level. Such an increase in wages, if it develops into a wage price spiral, will cause inflation to be sustained, independent of the state of excess demand.[7]

Apart from whether or not an increase in the price level takes place as a result of increase in the money supply, price increases can take place if the velocity of money circulation increases. This derives from the identity relationship, which states that when real output is constant, the price level is a function of the money supply and its velocity. Borrowing from the quantity theory, inflation, by reducing the real money supply, will induce people to hold fewer savings in the form of real balances. People will reduce their holdings of excess money balances, and instead will convert a large portion of their portfolios into real assets. In trying to do so, they will increase the velocity of the money

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[7] Ibid.

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in circulation. If the level of output does not respond to increases in velocity, the price level will rise.

There are two reasons, however, why a condition for hyperinflation is not likely to develop. First, it is unlikely that the inflation rate will become so severe that people will reduce their cash holding more than in proportion to the inflation rate. Second, it is not certain that all excess cash holdings be spent on goods and services. It is more likely that part of the excess balance will be absorbed by the system as if it was invested in the form of assets, the real values of which are not adversely affected by inflation.[8]

4.   Structural Inflation

This theory is identified with the existence of various bottlenecks in the economy, and was proposed to deal specifically with the economic situation of less developed countries.[9] Generally speaking, the economic and social structure of the less developed countries is characterized by the existence of wide variety of rigidities in such areas as foodstuffs, electricity, skilled labor, technology and infrastructure. According to this theory, it is the pressure of economic development on such underdeveloped factors and institutions which lead to inflation. It is assumed that a price rise will first appear in the sector where rigidities exist, and then will spill over to the rest of economy via the cost mechanism. On the other hand, it is recognized that while rigidities exist in some sectors there are other sectors which may be expanding faster than the needs of economic development. But here again the downward rigidities of wages and prices are the

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[8] Brooman, F., Jacoby, H.D., *Macroeconomics: An Inroduction to Theory and Policy*, Aldine Publishing Company, Chicago, 1967.

[9] *The Chinese Economy in 1991 and 1992: Pressure to Revisit Reform Mounts*, August, 1992.

cornerstone of the analysis. For the general price level to rise as a result of the inelasticity of supply in some sectors, wages and the prices must resist decline in the face of expanding supply elsewhere in the economy.

To avoid inflation, according to the structuralist model, is to sacrifice growth. Inflation can only be brought down by having the economy expand at rate consistent with the growth that can be achieved in those areas where rigidities exist.

5. Surplus Payment Inflation

Two theories will be discussed in this part: First, the quantity theory of money, and second, the reserve flow mechanism. The quantity theory obtained its greatest acceptance when it became one of the first propositions in economics to achieve mathematical formulation:

$$M \times V = P \times Q$$

where M equals the money supply, V is its velocity (the average number of times that the monetary unit is used in carrying transactions), P the average level of prices, and Q the volume of trade. Depending on the use we wish to make of the quantity equation, Q could be defined with reference to all transactions or only those resulting from the sale of newly produced final goods. If all the definitions are consistent, the quantity equation is an identity: the total value of payments in money equals the total value of items for which payments are made. The equation acquires greater significance when the assumptions are added that V and Q are not subject to much variation and that therefore a change in M is likely to be reflected in a similar change in P.

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Several assumption will be in effect throughout this analysis, mainly: the flow of foreign reserve to the domestic economy is not sterilized if a real balance effect is to take place; and the international reserve is the sole determinant of the money supply. The letter assumption is unrealistic in the sense that the money supply in an open economy is determined by two factors: international reserves and domestic money and credit creation. However, ignoring domestic credit creation will not change the conclusion, given a fixed exchange rate system. For the economy to be in equilibrium three conditions must be met simultaneously:[10]

- The money supply and the money demand should be in equilibrium; that is, no excess supply of and no excess demand for money.

- An equilibrium in the balance of payments; that is, no surplus, no deficit.

- The demand for domestic output is not in excess of its supply.

Violation of any of the three conditions will necessarily disable the equilibrium.

The concern here is to show how inflation is generated by a balance of payments disequilibrium; that is, by a balance of payments surplus. A surplus occurring in an economy as a result of positive net exports will lead to an increase in the money supply. If such increase is in excess of the demand for money in that economy and if the economy is operating at a full employment level of income, excess demand for goods and services will develop. This, a demand pull, will lead to inflation. The sequence of the process can be described as follows.

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[10] Ibid.

Part of the income accruing to the export sector is spent on increased imports, part is saved, and another part is spent either directly on consumption of goods and services or is reinvested. The latter means more production and more employment. Hence, more income is received by owners and workers. Other sectors in the economy will be stimulated by such increase in incomes. The magnitude of the process will depend on the size of multiplier. If demand pressure is increased everywhere, the problem of the price level increase will be aggravated and the general price level will rise even further. Eventually, the price rise will be slowed or stopped, depending on the nature of the following process. The increase of expenditures in the economy will lead to increased demand from the export sector and hence fewer exports will be available for the foreign market. In addition, the increase in the price level will lead, in general, to more imports, as foreign goods become cheaper in the domestic market, and less exports. However, in a more specific case, the effect of the price increase on the quantity exported/imported, and its value, depend on the price elasticity of demand for the product in question. When foreign demand for the export is elastic, a percentage change in the price level will lead to a proportionately higher change in the quantity demanded. That is, an increase in the price level will cause the quantity demanded to decrease more than in proportion and the value of the exports will be reduced. A price inelasticity of foreign demand for exports may not lead to a decrease in the quantity demand, and hence an increase in the price level will lead to increased revenue from exports. For a given foreign exchange rate, real

imports will be increased with rising domestic prices as foreign commodities are substituted for domestic commodities, assuming such substitutability exists.[11]

In summary, the increase in the money supply will lead to increased incomes and a rise in the price level. Exports and their value might decrease, depending on the price elasticity of foreign demand for exports. Import will increase through the rising income and the price level will lead to an outflow of money. In addition, the increased money supply leads to a capital outflow by exporting downward pressure on the rate of interest. If the total result is net money outflow, the money supply will decrease and the price level will start to subside.

6.   Imported Inflation

Imported inflations are those in which price increases are transmitted to the domestic economy through higher price of imported goods and services, assuming that such increases in the prices of the goods and services are not subsidized by the monetary authority. Such a price increase will be spread throughout the economy, hence tending to equalize the rate of inflation between countries in the long run. The difference in the rate of inflation between countries is attributed to the existence of two sectors within one economy, the tradable and non-tradable sectors. It is assumed that price rises in tradable goods sectors are translated to the whole economy through the wage mechanism. That is, the rise in price of the imported goods to be followed by a wage increase in that sector.

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[11] Ball, R.J., *Inflation and the Theory of Money*, Aldine Publishing Company, Chicago, 1967.

The freedom of labor mobility within each country will lead to a transfer of such an increase to the rest of economy.[12]

Occasionally the inflation caused by international transmission can be explained by psychological factors. What happens to wage and prices abroad can influence the formation of domestic wages and prices. When labor in a specific country demands and realizes an increase in hourly wages, labor in other countries may follow suit. By the same token, the price increase abroad may lead to the formation of expectations about a worldwide price increase and thus it can be an explanatory force for price in a certain country.

In the above discussion, we deal with the inflationary problem in the capitalist country. However, socialist economies often claim that, thanks to central planning, they have banished this scourge of inflation. But this is not true. Suppressed inflation is chronic condition of the system. By definition, supressed inflation does not appear in the statistics, but it nonetheless exists under the surface. Suppressed inflation (the pricing of many goods of everyday use below market equilibrium) shows up in lines outside stores, shortages of goods, rampant black marketeering, and bribery. The freezing of prices of many consumer goods creates money illusion: the real prices of commodities are understated, and real cash balances in the hands of consumers are overstated by the price structure. The procedure necessitates huge budgetary subsidies, especially in agriculture and housing. These have been rising rapidly in recent decades.

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[12] Ibid.

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In discussions of socialist inflation, the importance of demand pull elements in the inflationary process is not denied. Inflation is characterized by the existence of excess demand, or the presence of rising prices, or some combination of the two. We can include under it: (1) the situation characteristics of many socialist countries where official prices are kept relatively stable but where product shortages are evident and liquid asset pile up in the hands of the public; and (2) the situation where, in the absence of excess demand, prices are pushed up by costs or by the efforts and ability of producers to increase profits principally by raising prices rather than increasing efficiency in production.

Although the consequences of inflation may differ substantially between capitalist and socialist economies, the similarities of the inflationary problem under the two systems are notable, particularly with regard to causes.

III. INFLATION IN MAINLAND CHINA

A. SPECIAL CONSIDERATIONS

The issue of inflation is of particular importance in the People's Republic of China today. This is because of historical occurences and the current leadership's intended direction for the country's economy.

Historically, two periods of national crisis were characterized by high levels of inflation. In the late 1940's, as the communist party was consolidating its hold on the country, there was a problem of hyperinflation. As Mao's "Great Leap Forward" foundered and finally collapsed in the early 1960's, there were two years of serious inflation. Where some western economies have come to view inflation as a fact of life, in China inflation can spur extreme political dissatisfaction. In fact, many authors have stated that rising levels of inflation in the late 1980's fueled the level of popular discontent that resulted in the Tinanmen Square protest in 1989.[13]

The social impact of inflation in China is of particular importance because of the government's ongoing intentions and actions designed to move the economy toward a free market system. As more progressive reforms have been implemented, greater tendencies toward inflation have appeared. This is percieved as inevitable in sytems making the transition from socialist to free market economies, but, for China, the transition is not so clear cut.[14] This is because what may be considered a parallel free market for agricutural products has existed for a long time in the PRC, and a similar

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[13] Naughton, Barry, "Inflation and Economic Reform in China", *Current History*, September, 1989.

[14] Naughton, Barry, "Inflation in China: Patterns, Causes, and Cures", , *China's Economic Dilemmas in the 1990s: The Problems of Reforms, Modernization, and Interdepedence*, US Congress Joint Economic Committee, p. 153.

parallel market for industrial materials has existed since at least 1984. As dicusssed below, the presence of prices generated in these free markets has added a level of complexity to the interpretation of price behavior in China in the recent past.

B.   CONSUMER GOODS IN THE CHINESE MARKET

It is difficult to speak of a single rate of inflation in the Chinese market. This is because prices for urban and rural consumer goods, industrial products, and building services have all diverged widely over the past decade or so.[15] While this is true, the progression of market reforms is leading to a convergence among the various sectors of the Chinese economy, such that a consumer price index begins to hold meaning upon which policy decisions may be reasonably based.

There are two principal distinctions to be made in the consumer goods sectors: the first is between food and non-food items, and the second is between staple food and nonstaple food. The government of the PRC has continued to control prices for staple foods; at the same time, a broad "farmer's market" for nonstaple food items exists. The net result of this condition is that price reforms begun in 1978 have had minimal impact on inflation in the food sector that arises from the normalization of food prices. This is because, on one hand, the staples (principally grains) are still controlled by government pricing, and the non-staple items have been normalizing due to the existence of free "farmer's markets" in the urban areas for quite some time. Nevertheless, through what appears to have been expectation inflation, food prices rose in 1988 by about 23 percent, and the prices of non-staples such as meat, poultry, eggs, and seafood rose by 30.4

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[15] Ibid, p. 136.

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percent over the same period (see Table 1). The importance of food in the Chinese economy cannot be overstated. In the words of E.N. Anderson:

> ...expenditures on food as a percentage of income rise as people get richer. In all other areas, Englels Law Holds. [i.e., food takes less of the family budget as income increases. The reason is that [food is] the great social cement. Even the most trivial matters can be an occasion for a great feast.[16]

Year	1981	1982	1983	1984	1985	1986	1987	1988
General Price Index	100	103.5	107.7	108.0	126.3	136.0	157.5	207.7
Grain	100	100.4	97.8	87.5	89.1	107.5	127.0	212.0
Vegetable Oil	100	93.3	92.0	88.0	95.0	103.4	114.3	166.1
Dried Vegetables	100	104.5	106.2	101.5	108.3	127.6	145.0	191.1
Fresh Vegetables	100	102.7	112.6	109.3	132.9	141.9	169.4	190.4
Meat, Poultry, Eggs	100	104.2	107.6	110.3	129.3	137.8	164.5	210.7
Aquatic Products	100	111.2	125.1	134.7	170.0	181.9	219.7	280.8
Fresh Fruit	100	102.7	114.2	121.5	157.0	175.5	191.1	300.4
Table 1. Market Price Indices by Category Of Commodity, 1981-1988.[17]								

Other consumer goods, such as traditional Chinese medicines, saw prices increase as high as 34.8 percent in this period. Much of these extreme jumps in inflation came about, as noted above, because of rumors government action, declared government initiatives, and projected bank restrictions on personal savings withdrawals, which precipitated panic buying and runs on banks in some cities, most notably in Shanghai in late 1988.

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[16] Anderson, E.N., *The Food of China*, Yale University Press, 1988, p. 200.
[17] Source: China Statistical Yearbook.

To maintain peace in the face of surging retail prices for food and industrial consumer goods, urban subsidies were handed out liberally; the Beijing subsidy in the first half of 1988, for example, exceeded that of the first half of 1987 by 60 percent.

C. PRODUCER GOODS

The spark of extreme expectation inflation in late 1988 was applied to an inflationary climate that was suffering from cost-push inflation. In an effort to normalize pricing, as part of the ongoing attempt to liberalize the economy, the government had allowed increases in key sectors of the economy over which it had control, including industrial producer goods.

For example, as early as 1987, the price of machinery in some larger Chinese cities began to skyrocket. This increase in machinery cost was coupled with increases in material costs that had been planned as part of the governments price adjusting strategy. It is commonly held, however, that as much as half of the inflation occuring over the period 1978-1989 can be attributed to raw inflation, as opposed to necessary price adjustments.[18]

All of the increases in prices led the government to increase wages as well (and thereby increase the cost of construction, production, etc.), to the point where wage increases stimulated further price increases. State sector wages expanded by 20.1 percent in the first three quarters of 1988, with the bonus component rising 46.6 percent (see Table 2). Wages increases greatly exceeded increases in labor productivity. Wage

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[18] Honahan, P., "Note on the Chinese Inflation", World Bank, August, 1988.

increases during the period 1981-1985 were nearly twice as great as increases in the productivity of the industrial labor.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Productivity	3.4	3.8	-0.6	4.4	8.3	10.5	13.5	5.0	10.4	14.6
Wage	9.5	13.9	1.1	3.0	3.5	19.5	17.3	16.6	9.3	19.9
Retail Prices	2.0	6.0	2.4	1.9	1.5	2.8	8.8	6.0	7.3	18.5
Market Price	-4.5	2.0	6.6	3.5	4.1	0.3	16.9	7.7	17.0	28.7
Table 2. Percent Industrial Wage and Productivity Growth Rates, 1979-1988.[19]										

The officially tabulated wage increases probably understate the actual situation, because a good part of compensation takes the form of in-kind fringe benefits (for example, free lunches or clothing allocations); some of these are not technically legal, an occurrence which have been rising rapidly in recent years.

The resulting effect of price and wage increases on net income, however, was not a balancing one. To the contrary, the effect was disastrous. Real inflation had made such an impact that, in Guangdong Province, in South Coastal China, half of the urban population was officially estimated to have experienced real income erosion in the first half of 1988. This number was 40 percent in Shanghai. Nationwide, in 1987 the share of urban and rural households whose real income had been eroded by inflation was 40 percent, up from 20 percent in 1986.[20] This, inevitably, led to work slowdowns and strikes, some involving more than a thosand workers, which occurred beginning in 1988.

Inflation has also been stimulated by the general desire for more industrial investment. This has been particularly true of fixed investment by provincial and lower-

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[19] Source: China Statistical Yearbook.
[20] Yungi, Li, *Freeing the Banks from Beijing's Grip*, Asian Wall Street Journal, November 7, 1988.

level government authorities and enterprises that account for roughly two-fifths of total fixed investment in China (see Table 3). This has come about as a result of loosening government positions on the credit policies in the Chinese bank, intended to allow more locally-controlled investment to occur. Between 1985 and 1988 credit expanded rapidly, though there was no significant central bank lending. The increase in lending has been attributed to the central bank lowering the reserve requirements for local banks, allowing them to increase local lending. The central bank of China has often been criticized for lacking experience in controlling the economy, but movement of lending from the central bank to local banks saw an explosion in lending.[21] The inflationary effect of investment at the local level was further complicated by the fact that, in rural areas, labor for construction of new ventures is provided by "teams" which bid (and to some extent *set*) prices, rather than the historical state owned and run construction firms.

Year	1986	1987	1988	1989	1990	1991
Total	100	100	100	100	100	100
By ownership						
State-owned units	66.1	63.1	61.4	61.3	65.6	65.9
Collectively-Owned Units	12.9	15.00	15.8	13.8	11.9	12.7
Individual	21.0	21.9	22.7	24.9	22.5	21.5
By source of finance						
State Budget	16.0	13.1	9.1	8.3	8.7	6.8
Domestic loans	20.1	23.0	20.6	17.3	19.6	23.5
Foreign Investment	3.6	4.8	5.8	6.6	6.2	5.7
Self Raised Funds	60.3	47.9	64.5	56.9	52.3	52.3
Others	...	11.2	...	10.9	13.1	11.8
Table 3. Total Fixed Asset Investment, 1986-1991.[22]						

[21] Naughton, Barry, "Inflation in China: Patterns, Causes, and Cures", China's Economic Dilemmas in the 1990's: The Problems of Reforms, Modernization, and Interdependence., p. 154.
[22] Source: China Statistical Yearbook.

The government's plan for 1988 called for a decrease of 14 percent in state sector industrial fixed investment, but in the first quarter of that year alone, the increase was 11 percent. Uncoordinated investment by localities has resulted in wasted resources and a duplication of industrial capacity. The technological level of many locally constructed plants is low, the material utilization rate is high, and managerial expertise is poor.

Hence, investment and costs of wages and materials were all on the rise at once, leading to goverment mandated increases in the money supply, which rose an an estimated yearly rate of 30 percent between 1984 and 1986 (see Table 4).

D. EFFECTS ON GNP AND TRADE

Although the Chinese economy has enormous shortcomings and inefficiencies, it also is a system that held about 45 billion in hard currency reserves in late 1992, generated a worldwide trade surplus of about 8 billion in 1991 (see Figure 1), and had a GNP growth rate of about 13.2 percent in 1992 (see Figure 2). Nonetheless, China's economy is inefficient in many respects. It remains an agricultural society whose nearly 1.2 billion people collectively remain at a low per capita GNP level. Suppressed inflationary pressures can very rapidly lead to explosions in this system.
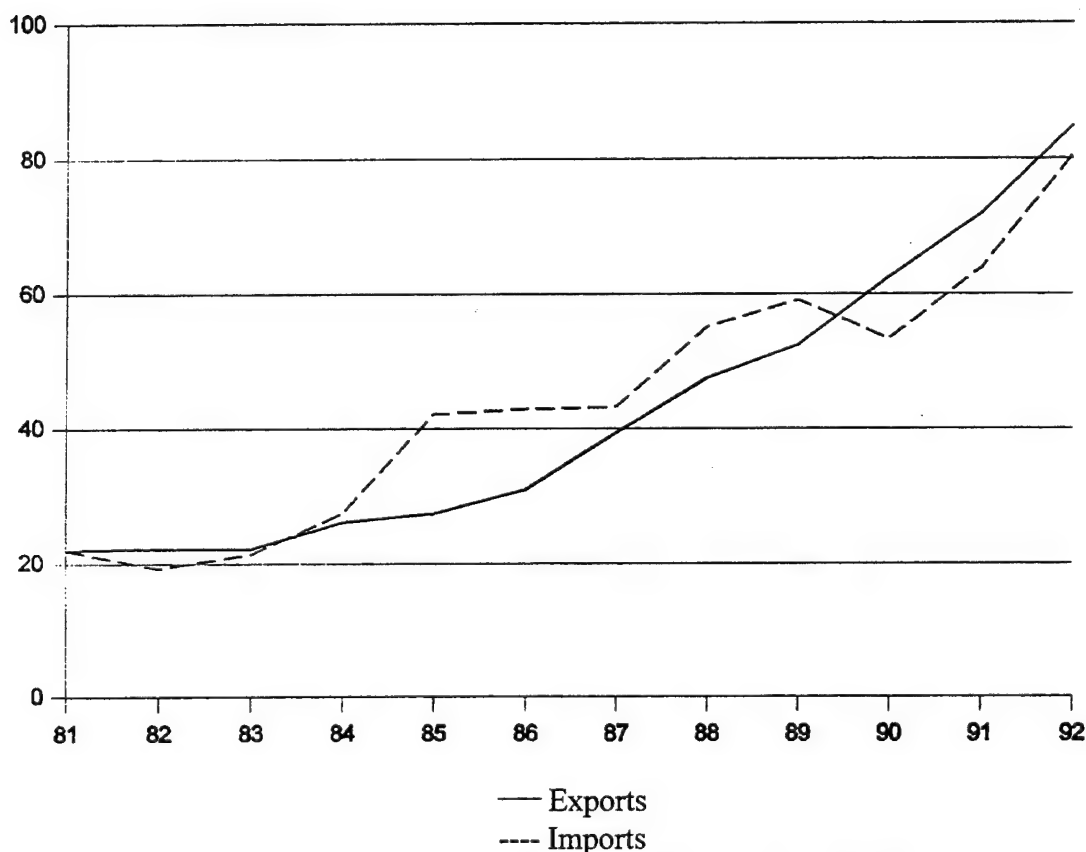
—— Exports
---- Imports
Figure 1. Exports and Imports in China, 1981-1992.[23]

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[23] Source: China Statistical Yearbook.

Year	Net Domestic Assets	Broad Money	Currency
1978	11.7	9.5	8.5
1979	20.6	33.0	26.3
1980	37.3	32.9	29.1
1981	17.8	19.5	14.5
1982	7.9	13.1	10.9
1983	17.0	19.3	20.7
1984	31.1	42.4	49.4
1985	22.1	17.1	24.7
1986	33.9	29.3	23.3
1987	21.5	24.2	19.4
1988	20.7	21.0	46.6
Table 4. Growth Rate Of Monetary Aggregates.[24]			

[24] Source: People's Bank of China.
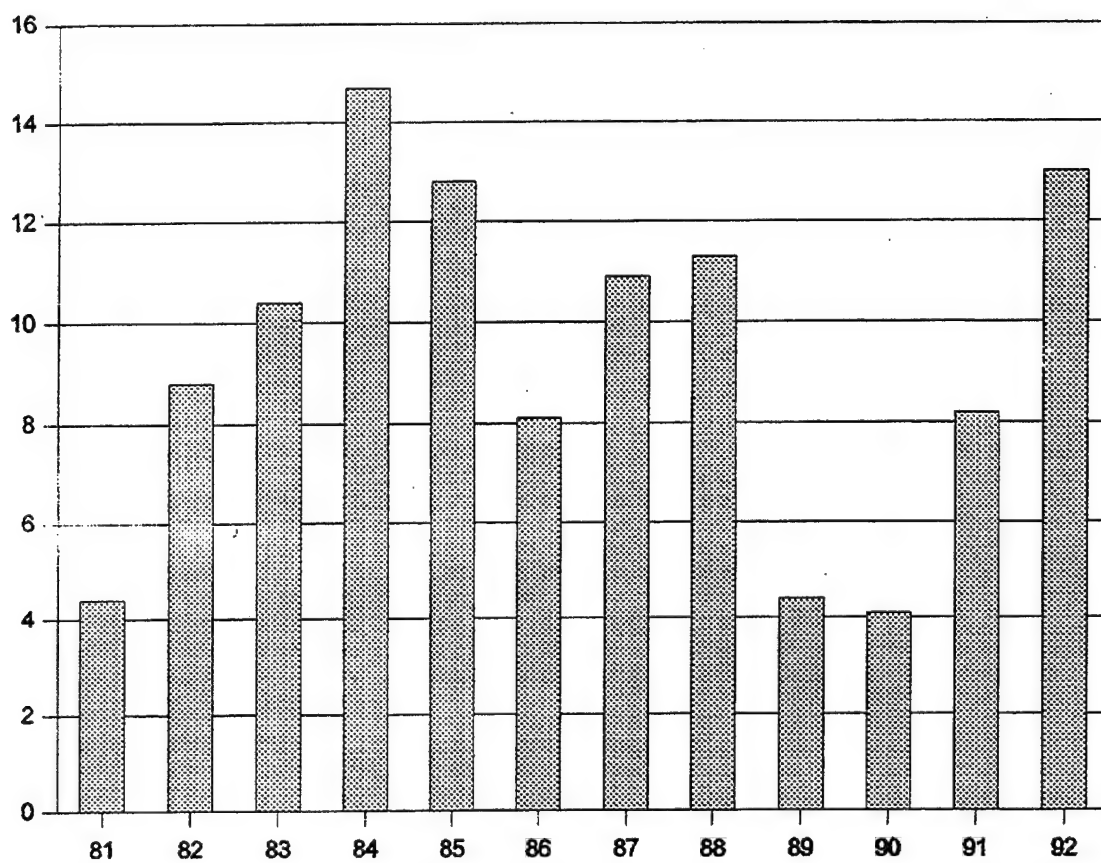
Figure 2. China's Real GNP Growth, 1981-1992.[25]

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[25] Source: China Statistical Yearbook.

IV. PRICE DEFLATORS

Price deflators play an important role in economic analysis. One of the most common uses of price deflators is to compare monetary figures relating to two different points in time. Since prices have been effected by inflation; the undeflated dollar is not a good measuring rod, as it is worth less now than it was in the past.[26] For example, suppose that the average salary of a worker is 1,000 dollars per month in the previous year and that the salary has grown to 1,100 dollars per month this year. However, the worker does not feel better off than he was last year. How can we account for the change? The obvious answer is that a dollar in this year is not worth as much as it was last year. When we wish to know whether the purchasing power, or value, of money in terms of many commodities has changed, we encounter a more difficult problem. The prices of some commodities may be lower than they were previously, while those of others may be higher. There are many different methods for calculating changes in the price level, that is, the average price of a number of commodities. Each of these methods, however, is intended to show the average price at one date as compared with the average price at another. In calculating a price index number, the average price for the base period is set at 100. Then the average price at a later period has increased 10 percent, the price index number for that period is 110. If it has fallen 10 percent, the price index number is 90. In this chapter we will address the basic theory of price deflators and the use of prices deflators to measure economy activity.

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[26] Hildebrandt, Gregory G. , *Price Deflators in Defense Analysis and Planning*, August, 1985.

A. DEFINITION OF INDEX NUMBER

An index number is a percentage, by which a measurement in a given period is expressed as a ratio to the measurement in a designated base period. The measurements can be concerned with price, quantity, or value. Usually we may have index numbers comparing the cost of living at different times or in different countries or localities, the physical volume of production in different years. Perhaps the best-known type of index is that far a change in price level over a period of time. Such indexes have been in use longer and currently are the most numerous. One use of price index number is that of deflating a value series in order to covert it into physical terms. For example, we might wish to convert a time series representing value of construction contracts awarded to a physical basis by deflating with an index of construction costs. When the index number represents a comparison for an individual product or commodity, it is a simple index number. In contrast, when the index number has been constructed for a group of items or commodities, it is an aggregate or composite index number.

1. Construction of Simple Indexes

A simple index measures the relative change from the base period for single item. To determine a simple index of price in any given time period, express the price in the given time period. When p_j indicates the price of a commodity in an given period and p_0 indicates the price in the base period, the general formulation for the simple price index is:

$$I_p = \frac{p_j}{p_o} \times 100$$

Similarly, where q_j indicates the quantity of an item produced or sold in the given period and q_o indicates the quantity in the base period, the general formation for the simple quantity index is:

$$I_q = \frac{q_j}{q_o} \times 100$$

Finally, the value of a commodity in a designated period is equal to the price of the commodity multiplied by the quantity produced or sold. Therefore $p_j q_j$ indicates the value of a commodity in the given period, and $p_o q_o$ indicates the value of the commodity in the base period. The general formula is:

$$I_p = \frac{p_j q_j}{p_o q_o} \times 100$$

2. Construction of Simple Aggregate Price Indexes

A simple aggregate price index measures relative change from the base period for a group of closely related items. To obtain an aggregate price index, the price of several items or commodities could simply be summed for the given period and for the base period, respectively, and then compared. Such an index would be an unweighted aggregate price index. An unweighted index generally is not very useful because the implicit weight of each item in the index depends on the units upon which the prices are based.

3.   Construction of Weighted Aggregate Price Indexes

In order to allow each commodity to have a reasonable influence on the index, it is better to use weighted rather than a simple aggregate of prices. To construct a weighted aggregative index, a list of definite quantities of specified commodities is taken, and calculations are made to determine what goods are worth each year at the year prices. Obviously the process is merely that of multiplying each unit price by the number of units and summing the resulting values for each period. The general formula for the weighted aggregate price index is:

$$I_p = \frac{\sum p_{ji} q_{oi}}{\sum p_{oi} q_{oi}} \times 100$$

The index for some item index can be combined into an aggregate price index. However, construction of the weighted aggregate price index necessitates obtaining information on the quantities of the item. Sometimes it is difficult in practice to find such average quantities of all items. To meet this difficulty, the formulas can be represented by a form in which information on the quantities consumed is not directly involved. The formula as follow:

$$100 \cdot \frac{\sum p_{ji} q_{oi}}{\sum p_{oi} q_{oi}} = 100 \frac{\sum r_i w_i}{\sum w_i}$$

where $\sum p_{ji} q_{oi}$ represents the total cost of all items in period 0, $p_{ji} q_{oi}$ represents the total cost of ith item in period 0, $\dfrac{p_{ji} q_{oi}}{\sum p_{ji} q_{oi}}$ represents w_i, the proportion of cost of the ith

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item in period 0, and r_i is the price relative of the ith item, $\dfrac{p_{ji}}{p_{oi}}$. Therefore, the index

number becomes a weighted average of price relatives.

B.   LASPEYRES INDEX

This index formula reprices a market basket of the base period, substituting each

year the current year's prices for the base year's but leaving quantities unchanged.   In

effect, it answer the question, How much more would the goods and services purchased at

some specific time in the past cost at today's prices?

The formula for the price index is:

$$I_{oj} = \frac{\sum p_{ji} q_{oi}}{\sum p_{oi} q_{oi}}$$

where p_{ji} is the price of the ith good or service in year j; p_{oi} is the price of the ith good or

service in year o; q_{oi} is the quantity of the ith good or service purchased in year o.

Note that $\sum p_{oi} q_{oi}$ is the total market value of a combination of goods and

services purchased in year o.

Also, q_{oi} may be written as q_{ai}, where this quantity represents an amount of the

ith item which was purchased in an arbitrary year a.   This q_{ai} may be interpreted as some

average quantity which was purchased in given year.   The important thing is that the

quantity measures the item's relative importance within the market in year o.   In this case,

the relative importance of the ith item in the year that the item was puchased has no direct

effect on the calculated price index.

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C. PAASCHE INDEX

This index deals with price change differently: the market basket is changed at each current index period and priced in base period and current period prices. It should be noted that although the market basket continually changes, it is held constant for each paired comparison, base to current year. The index is thus not a changing weight index, although unlike the Laspeyes index, the weights differ from one current period to another.

The price index formula is:

$$I_{oj} = \frac{\sum p_{ji} q_{ji}}{\sum p_{oi} q_{ji}}$$

where p_{ji} is the price of the ith good or service in year j; p_{oi} is the price of the ith good or service in year o; q_{jii} is the quantity of the ith good or service purchased in year j.

D. INDEXES OF QUALITATIVE CHANGE

In conventional index number theory we assume that quality variation does not exist. This means that the goods in the world are homogeneous. However, some dimensions of quality that can be quantified and measured such as for car is speed, engine horse power, fuel consumption, shipping weight. The way to do this is to find what relationship exists between the price of a particular commodity and its quality. Griliches notes that a variety of models of a particular commodity with different specifications can be observed to sell at different prices during the same time period. This data can then be used to derive implicit prices per additional unit of chosen dimension of the commodity. An adjustment in price is then made to account for the change in specifications of

commodity. According to Griliches: One should "derive implicit specification prices from cross-sectional data on the price of various "models" of the particular item and use these in pricing the time series change in specifications of the chosen (average or representative) item."[27]

[27] Griliches, Zvi, *Hedonic Price Indexes for Automobiles: An Econometrics Analysis of Quality Change*, Harvard University Press, 1971.

V. PRICE DEFLATORS IN CHINA

This chapter turns from the previous theoretical discussion to the actual use of price deflators with which to analyze price change in mainland China. The chapter begins with a description of the data employed in the analysis, followed by a reiteration of the objectives of the linear analysis. The main body of the chapter discusses the construction of linear and log-linear regression models and presents the results and interpretation of the regression analysis.

A. DESCRIPTION OF DATA

The data employed in this analysis was obtained from the China Statistical Yearbook. Comprised of monthy statistics covering the period from January to December, 1994, this dataset is categorized into fourteen groups of commodity price indices for thirty-five individual cities in China. In order to simplify the view of these statistics, and to construct an effective regression model, the data was rearranged into five categories of price indices, and the geographical breakdown was translated into two regions. The five categories obtained are agriculture, industry, construction, transportation, and commerce. The two geographical regions are coastal areas and interior areas. Appendix B contains a summary listing of all of the data used in this analysis.

B. OBJECTIVES OF ANALYSIS

To review, there are three principal objectives of the current analysis. The first of these is to identify the relationship between the price index of a given category and the output value of the region in which the activity takes place. The second is to analyze the

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effect of changes in national income or output value on the price index for each region. The third objective is to be able to predict the value of future price indices based upon changes in income and output values.

C.   REGRESSION ANALYSIS

The reorganization of the dataset from fourteen to five categories and from thirty-five cities into two regions was necessary to simplify the inputs of the regression model. However, in building a regression model, it is necessary to restructure the variable inputs so as to provide binary information (1,0). Such binary variables are commonly referred to as *dummy variables*, and a value of 1 for such a variable indicates that the particular sample record is a member of the category which that variable is assigned to represent. In this case, dummy variables were created to represent membership in each of the five categories of price indices and also for either the coastal or interior geographic regions.

In regression analysis, it is common to eliminate one of the dummy variable choices from the model. Therefore, a value of 1 for any given remaining category variable indicates membership in that category. Values of 0 for all of the category variables indicates that the sample is not a member of the category in question. The eliminated variable constitutes a reference group, but it does not matter which of the variables is chosen for elimination from model construction.

For this analysis the entire set of binary variables employed were as follows:

- **Da** -- agriculture (the reference group)
- **Db** -- industry
- **Dc** -- construction

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- **Dd** -- transportation

- **De** -- commerce

- **Dr** -- coastal region

- **Di** -- interior region

As discussed above, a value of 1 for any of these variables indicates membership in the category or region represented. For any given sample, only one category variable (agricluture, industry, construction, transportation, commerce) and one regional variable (coastal, interior) may be valid (value=1).

1. Model 1

The first model to be constructed examines the effect that membership in a given activity category has upon the price index. The model is constructed as follows:

$$P = f(category \ variables)$$
$$= \beta 0 + \beta 1 Db + \beta 2 Dc + \beta 3 Dd + \beta 4 De + U$$

where P is equal to the price index, β reflects the change in P attributable to the category variable, and U represents the error term of the model.

Note that this model does not take into account the influence of membership in either the coastal or interior regions. Note also that the category variable Da (agriculture) is not explicitly included as an explanatory variable, but is the reference category represented by the intercept term $\beta 0$.

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2. Model 2

The second regression model includes a variable to reflect whether or not the subject index is in the coastal region. Otherwise, the model retains the same structure as Model 1:

P = f(category variables, region variable)

$$= \beta_0 + \beta_1 D_b + \beta_2 D_c + \beta_3 D_d + \beta_4 D_e + \beta_5 D_r + U$$

3. Model 3

The third regression model includes an output variable to examine whether the value of ouput affects the price index.

P = f(category variables, output value)

$$= \beta_0 + \beta_1 D_b + \beta_2 D_c + \beta_3 D_d + \beta_4 D_e + \beta_5 OUTPUT + U$$

4. Model 4

The fourth regression model adopts the log-linear format. Each coefficient for output represents the percentage change in the price index for every unit increase in the respective price index.

Ln(P) = f(category variable, output value)
$$= \beta_0 + \beta_1 D_b + \beta_2 D_c + \beta_3 D_d + \beta_4 D_e + \beta_5 Ln(OUTPUT) + U$$

D. RESULTS AND INTERPRETATION

The software program MINITAB© was used to calculate the regression models for analysis. This section presents the results obtained for each of the four basic models. Other regression models are reported in Appendix A.

1. Model 1

The regression equation for this model is:

$$P = 140 - 27.4Db - 27.2Dc - 38.7Dd - 27.6De$$

The results reported by MINITAB for this model are presented in Table 5.

PREDICTOR	COEFFICIENT	STANDARD DEVIATION	t-RATIO	p
Constant	140.149	2.218	63.17	0.0001
Db	-27.442	2.396	-11.45	0.0001
Dc	-27.230	3.137	-8.67	0.0001
Dd	-38.720	3.137	-12.34	0.0001
De	-27.573	2.430	-11.35	0.0001
F= 43.82	R-sq=.265		R-sq(adj)=.259	

Table 5. Regression Model 1 Results

In viewing the results reported in the table, the following observations may be made:

- Since F=43.82 greatly exceeds F(0.01; 4,485)=13.5, the null hypothesis that there is no relationship between the dependent variable and the type of good may be rejected. There is a relationship in the population between the independent categorical variables and the dependent variable (price index).

- The R^2 value is 30194/113739.9, or 26.5, indicating an approximate 26.5% variability in the responses to the predictor.

- Because the t test values are geater than (in absolute value) 1.96, the null hypothesis that $\beta i = 0$ is rejected for each category coefficient.

The model results indicate that the price index in the category of agriculture is much higher than that found for the others. Because of this, it is possible to say that an important cause of inflation in China is an increase in the price of food.

2.   Model 2

The regression equation for Model 2 is:

$$P = 140 - 27.4Db - 27.2Dc - 38.7Dd - 27.6De - 0.98Dr$$

The results of running the model in MINITAB are presented in Table 6.

PREDICTOR	COEFFICIENT	STANDARD DEVIATION	t-RATIO	p
Constant	140.458	2.255	62.27	0.0001
Db	-27.442	2.397	-11.45	0.0001
Dc	-27.203	3.139	-8.67	0.0001
Dd	-38.720	3.139	-12.34	0.0001
De	-27.573	2.431	-11.34	0.0001
Dr	-0.984	1.278	-0.77	0.441
F=35.15	R-sq=.266		R-sq(adj)=.259	

Table 6. Regression Model 2 Results

The following observations may be made in regard to the results of running Model 2:

- The null hypothesis is still rejected, as F=35.15 exceeds F(0.01; 5,484)=9.02

- It is not possible to reject the null hypothesis that $\beta5 = 0$, because the t-test value is -0.77, and because the critical value for the t test is t(0.05;484)=1.96. It is therefore possible to conclude that region is not a significant contributor to the model, and may be removed from the regression equation.

3. Model 3

The resulting regression equation for Model 3 is:

$$P = 134 - 27.4Db - 27.2Dc - 38.7Dd - 27.6De - 0.054 \, OUTPUT$$

The results of regression analysis for the model are presented in Table 7.

PREDICTOR	COEFFICIENT	STANDARD DEVIATION	t-RATIO	p
Constant	134.43	20.48	6.56	0.0001
Db	-27.442	2.399	-11.44	0.0001
Dc	-27.203	3.140	-8.66	0.0001
Dd	-38.720	3.140	-12.33	0.0001
De	-27.573	2.433	-11.34	0.0001
OUTPUT	0.0538	0.1916	0.28	0.779
F=35.01	R-sq=.266		R-sq(adj)=.258	

Table 7. Regreession Model 3 Results.

Of note in the results presented above is that the t test result once again indicates a lack of significance for the added variable, output value. Therefore, output value was removed from the equation.

4. Model 4

The resulting regression equation for Model 4 is:

$$Ln(P) = 4.67 - 0.222Db - 0.226Dc - 0.324Dd - 0.223De - 0.057 \, Ln(OUT)$$

The results of regression analysis by MINITAB are presented in Table 8.

PREDICTOR	COEFFICIENT	STANDARD DEVIATION	t-RATIO	p
Constant	4.6735	0.8097	5.77	0.0001
Db	-0.22157	0.02023	-10.95	0.0001
Dc	-0.22553	0.02649	-8.51	0.0001
Dd	-0.32388	0.02649	-12.23	0.0001
De	-0.22286	0.02052	-10.86	0.0001
OUTPUT	0.0571	0.1735	0.33	0.742
F=33.50	R-sq=.257		R-sq(adj)=.249	

Table 8. Regression Model 4 Results.

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Because the model employed for these results is a log-linear regression, the output coefficient represents the percentage change in price index for each one percent increase in output.

To understand why the ouput variable is not significant, it is helpful to consider how increased demand for and supply of output might affect price. The concept of demand and supply are the most important tools of economic analysis, because the prices and quantities sold in a market are determined by demand and supply. In general, consumers are willing to buy more of a good the lower the price of the good, when the prices of other variables are held constant. This relation is called the law of demand. When price falls (rises) and consumers purchase more (less) of a good, other things remaining the same, we say that quantity demanded increases (decreases). Demand does not increase or decrease when price changes. Demand is said to increase or decrease only if one or more of the determinants of demand change. Changes in demand are reflected in shifts of the demand curve, either to the right for an increase in demand, or to the left for a decrease in demand.

Basically, the amount of goods offered for sale in the market depends upon a large number of vaiables. However, the price of the product would affect the quantity offered for sale. This relation is attributable to two reactions: (1) a higher price would lead to greater profits for producers selling the good, and thus they would be induced to produce and sell more, and; (2) the higher price and consequent higher profits would motivate the producer to increase supply. While the price of the good itself is the most important variable affecting the amount of the good offered for sale, the first among other variables

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is the level of available technology. An improvement in the state of technology would lower the costs of producing the good and therefore increase the quantity offered for sale.

In a general sense, the basic question is: What will be the impact on market price and output of changes in those determinants that cause a shift in the demand and supply curves? By comparing the market equilibrium positions before and after the change, we will be able to determine the direction. We know that if supply remains fixed and demand decreases, quantity and price both fall; if demand increases, price and quantity both rise. However, when demand remains constant and supply decreases, price rises and quantity falls; if supply increases, price falls and quantity increases. While both demand and supply change simultaneously, the resulting change in price and quantity are not predictable.

With this overview, we might be able to explain why changes in ouput do not have a significant effect on price. At the same time that demand increased in the Chinese economy, supply side changes may have eliminated the price rise. Simple demand and supply analysis, therefore, may not be able to explain the price increases that have occured.

VI. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to apply the theory of price indexes to the analysis of price changes in the People's Republic of China. Chapter II reviewed the serious problem with inflation experienced by China in the late 1980's, and examined several of the contemporaneous economic and political trends which may have contributed to the rate of inflation that occurred. In Chapter III, the theory of price indexes was reviewed, while the main body of work for this thesis is reported in Chapter IV, which presents the construction and results of several regression models that were constructed in an attempt to examine the relationship between inflation and several other measured economic factors at work in China.

There were four models constructed for this thesis. The first of these attempted to examine price indexes in the areas of agriculture, industry, construction, transportation, and commerce. The model results indicate a significant relationship between the categories of economic goods and the price index. Food was the economic category most strongly associated with increases in price. This suggests that increases in the price of food are a major cause of inflation in China.

The second model presented in Chapter IV added descriptive variables to the data on price indices to indicate whether the prices relate to coastal or interior regions of China. The objective of this addition was to look for a pattern indicating a significant relationship between location (coastal or interior) and inflation. The results of the model indicate that there is no such significant relationship.

In the third of the models presented in Chapter IV, an attempt was made to relate output value to inflation. Again, however, the model results indicate that no such relation is present. The final model presented in the chapter was the same as the third, but this time a log-linear formulation was employed. The results, however, remained the same.

In summary, the price of food was demonstrated to have a significant impact on the level of inflation in the People's Republic of China, but no similar relationships were found to exist for coastal versus interior region or output/income level.

APPENDIX A. OTHER REGRESSION MODEL RESULTS

P = f(region variable, category variable, national income)

The regression equation result is

P = 167 - 1.53 Dr - 68.1 Db - 97.4 Dc - 85.8 Dd - 56.8 De

   + 0.354DbNI + 0.610 DcNI + 0.409 DdNI + 0.254 DeNI - 0.231 NI

Predictor	Coef	Stdev	t-ratio	p
Constant	167.16	46.56	3.59	0.000
Dr	-1.527	1.517	-1.01	0.314
Db	-68.15	49.67	-1.37	0.171
Dc	-97.37	65.03	-1.50	0.135
Dd	-85.78	65.03	-1.32	0.188
De	-56.83	50.37	-1.13	0.260
DbNI	0.3538	0.4312	0.82	0.412
DcNI	0.6098	0.5645	1.08	0.281
DdNI	0.4090	0.5645	0.72	0.469
DeNI	0.2542	0.4373	0.58	0.561
NI	-0.2306	0.4049	-0.57	0.569

F = 17.64   R-sq = 26.9%   R-sq(adj) = 25.4%

where NI equals national income and the variables such as DbNI equals the product of the relevant category variable and national income.

P = f(region variable, category variable, national income)

The regression equation result is

P = 131 - 1.53 Dr - 27.4 Db - 27.2 Dc - 38.7 Dd - 27.6 De

   + 0.085 NI

Predictor	Coef	Stdev	t-ratio	p
Constant	130.90	14.41	9.08	0.000
Dr	-1.527	1.513	-1.01	0.313
Db	-27.442	2.399	-11.44	0.000
Dc	-27.203	3.141	-8.66	0.000
Dd	-38.720	3.141	-12.33	0.000
De	-27.573	2.433	-11.33	0.000
NI	0.0846	0.1259	0.67	0.502

F = 29.33   R-sq = .267   R-sq(adj) = .258

P = f(region variable, category variable, national income)

The regression equation result is

$LN(p) = 5.60 - 0.0134\ Dr - 0.453\ Db - 0.804\ Dc - 0.634\ Dd$
$\quad - 0.391\ De + 0.00201\ DbNI + 0.00503\ DcNI + 0.00269\ DdNI$
$\quad + 0.00146\ DeNI - 0.137\ LN(NI)$

Predictor	Coef	Stdev	t-ratio	p
Constant	5.596	1.875	2.98	0.003
Dr	-0.01342	0.01280	-1.05	0.295
Db	-0.4531	0.4176	-1.08	0.279
Dc	-0.8042	0.5475	-1.47	0.143
Dd	-0.6338	0.5475	-1.16	0.248
De	-0.3913	0.4236	-0.92	0.356
DbNI	0.002012	0.003625	0.55	0.579
DcNI	0.005029	0.004753	1.06	0.291
DdNI	0.002694	0.004753	0.57	0.571
DeNI	0.001464	0.003677	0.40	0.691
LN(NI)	-0.1374	0.3954	-0.35	0.728

$F = 16.89 \quad R\text{-sq} = .261 \quad R\text{-sq(adj)} = .245$

P = f(region variable, category variable, output value)

The regression equation result is

P = 132 - 1.00 Dr - 19.5 Db - 63.7 Dc - 27.0 Dd - 30.0 De

  - 0.0821 DbOUT + 0.342 DcOUT - 0.126 DdOUT + 0.022 DeOUT

  + 0.080 OUTPUT

Predictor	Coef	Stdev	t-ratio	p
Constant	131.91	24.89	5.30	0.000
Dr	-0.998	1.331	-0.75	0.454
Db	-19.461	8.936	-2.18	0.030
Dc	-63.68	30.89	-2.06	0.040
Dd	-26.96	17.30	-1.56	0.120
De	-29.96	30.48	-0.98	0.326
DbOUT	-0.08206	0.08849	-0.93	0.354
DcOUT	0.3418	0.2879	1.19	0.236
DdOUT	-0.1263	0.1827	-0.69	0.490
DeOUT	0.0218	0.2774	0.08	0.937
OUTPUT	0.0805	0.2343	0.34	0.731

F = 17.8   R-sq = .271   R-sq(adj) = .256

the variables such as DbOUT represent the product of the relevant category variable and OUTPUT.

P = f(region variable, category variable, output value)

The regression equation result is

LN(p) = 4.49 - 0.0088 Dr - 0.150 Db - 0.535 Dc - 0.184 Dd

   - 0.219 De - 0.000732 DbOUT + 0.00290 DcOUT

   - 0.00150 DdOUT - 0.00003 DeOUT + 0.097 LN(OUTPUT)

Predictor	Coef	Stdev	t-ratio	p
Constant	4.4908	0.9870	4.55	0.000
Dr	-0.00877	0.01121	-0.78	0.435
Db	-0.15041	0.07533	-2.00	0.046
Dc	-0.5351	0.2604	-2.06	0.040
Dd	-0.1841	0.1458	-1.26	0.207
De	-0.2192	0.2567	-0.85	0.394
DbOUT	-0.0007317	0.0007460	-0.98	0.327
DcOUT	0.002901	0.002427	1.20	0.233
DdOUT	-0.001501	0.001540	-0.97	0.330
DeOUT	-0.000034	0.002337	-0.01	0.989
LN(OUTPUT)	0.0969	0.2117	0.46	0.647

F = 17.4   R-sq = .264   R-sq(adj) = .248

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P = f(region variable, category variable, output value)

The regression equation is

LN(p) = 4.49 - 0.0101 Dr - 0.222 Db - 0.226 Dc - 0.324 Dd
    - 0.223 De + 0.097 LN(OUTPUT)

Predictor	Coef	Stdev	t-ratio	p
Constant	4.4919	0.8344	5.38	0.000
Dr	-0.01006	0.01112	-0.90	0.366
Db	-0.22157	0.02024	-10.95	0.000
Dc	-0.22553	0.02650	-8.51	0.000
Dd	-0.32388	0.02650	-12.22	0.000
De	-0.22286	0.02052	-10.86	0.000
LN(OUTPUT)	0.0967	0.1790	0.54	0.589

F = 28.04   R-sq = .258   R-sq(adj) = .249

APPENDIX B. MODEL DATA

Region	National Income	Agriculture	Industry	Construction	Transport	Commerce
Beijing	102.5	99.4	104.6	112.6	101.1	84.5
Tianjin	101.5	111.4	99.0	90.9	101.9	117.0
Hebei	103.7	101.9	106.7	86.7	105.7	96.7
Shanxi	104.4	106.5	110.5	83.5	88.4	89.2
Mongolia	102.4	94.5	110.2	98.4	118.3	98.1
Liaoning	102.1	95.2	103.1	95.4	105.7	108.4
Jilin	95.4	84.8	99.4	76.6	104.8	114.8
Heilongjiang	103.8	94.4	105.3	118.4	102.7	112.2
Shanghai	103.1	100.3	102.0	96.1	104.7	109.1
Jiangsu	100.4	97.3	103.3	85.5	95.5	102.4
Zhejiang	100.4	100.2	103.4	91.3	90.7	91.4
Anhui	104.5	102.0	109.8	85.1	81.0	119.3
Fujian	109.0	111.9	111.8	79.3	118.0	96.8
Jiangxi	106.8	105.3	108.8	98.8	108.0	110.0
Shandong	103.8	99.3	108.1	94.2	121.3	94.1
Henan	103.7	110.1	104.1	81.5	111.7	91.5
Hubei	101.7	104.8	104.6	77.6	108.2	85.5
Hunan	103.0	105.3	106.0	78.9	104.3	93.1
Guangdong	106.6	107.4	111.8	97.2	106.6	86.5
Guangxi	103.9	110.5	102.6	85.7	101.5	94.3
Hainan	105.2	103.0	104.6	133.6	105.8	100.4
Sichuan	101.5	101.0	102.8	95.9	100.6	102.1
Guizhou	103.7	105.1	107.2	87.2	115.0	90.4
Yunnan	105.7	102.9	109.0	101.3	116.2	104.0
Tibet	102.7	100.3	109.1	110.0	102.0	103.3
Shaanxi	103.8	108.3	109.3	90.2	112.2	50.1
Gansu	108.1	103.5	107.0	109.5	112.3	114.4
Qinghai	100.5	102.5	104.7	83.1	104.7	95.5
Ningxia	108.1	107.8	118.4	84.2	111.2	88.6
Xinjiang	105.6	102.5	108.4	95.8	121.3	107.9

Region	Total Output Value of Society	Agriculture	Industry	Construction	Transport	Commerce
Beijing	105.8	110.8	107.2	105.9	109.1	78.7
Tianjin	107.5	114.0	109.1	97.9	98.8	97.9
Hebei	105.4	103.1	108.8	84.4	105.8	94.3
Shanxi	105.9	107.4	111.2	83.0	102.3	86.8
Mongolia	106.4	99.5	112.6	94.2	119.7	92.3
Liaoning	104.3	95.7	105.9	95.9	105.5	103.8
Jilin	101.0	88.3	106.3	73.9	113.3	104.7
Heilongjiang	105.4	96.1	106.1	123.2	104.5	99.4
Shanghai	103.1	101.3	103.0	92.4	105.3	108.8
Jiangsu	102.3	100.3	104.4	86.1	99.2	100.2
Zhejiang	104.1	101.7	106.9	88.4	91.0	92.4
Anhui	104.6	102.3	110.0	83.7	92.5	111.3
Fujian	111.7	106.5	115.2	90.5	119.5	105.9
Jiangxi	107.6	105.4	109.7	96.8	106.4	112.5
Shandong	112.1	101.4	118.0	95.3	110.1	96.6
Henan	106.7	109.9	110.4	80.8	108.1	100.7
Hubei	102.9	105.0	106.7	73.9	100.6	83.1
Hunan	103.1	105.1	106.7	76.6	140.9	90.8
Guangdong	111.9	107.8	116.3	100.5	106.9	89.9
Guangxi	104.3	110.3	106.2	80.3	104.5	93.9
Hainan	106.8	102.4	104.9	134.1	106.2	100.6
Sichuan	103.6	103.7	105.5	96.2	100.9	102.6
Guizhou	103.6	104.8	107.4	89.3	100.8	91.2
Yunnan	105.3	102.9	106.8	101.2	115.6	106.0
Tibet	105.2	101.4	109.4	113.0	103.8	103.7
Shaanxi	104.9	105.9	109.7	92.9	100.8	61.4
Gansu	109.3	106.7	108.1	110.9	113.8	113.8
Qinghai	101.8	102.4	108.1	79.8	118.2	92.6
Ningxia	108.8	106.0	116.7	87.9	109.8	91.7
Xinjiang	108.2	104.7	110.4	96.2	122.7	109.2

	Parmaceutical and Medical Articles	Cosmetics	Books, Newspapers, and Magazines	Cultural and Recreational Articles	Daily Use Articles
Average Index	122.2	140.7	110.9	123.9	120.3
Beijing	116.1	128.1	105.9	127.5	116.0
Tianjin	117.2	135.5	104.7	109.8	113.0
Shijiazhuang	125.6	135.5	110.4	134.0	126.3
Taiyuan	122.5	141.4	101.4	131.8	133.8
Hohhot	125.2	158.2	109.6	124.9	113.8
Shenyang	124.0	134.4	107.7	131.8	145.3
Dalian	117.1	129.0	109.7	115.7	134.9
Changchun	124.0	140.4	122.8	115.9	117.8
Harbin	121.1	141.6	114.8	119.5	129.1
Shanghai	117.9	137.2	107.1	118.8	124.3
Nanjiing	121.3	147.5	104.9	122.3	116.1
Hangzhou	118.6	130.8	107.8	123.6	120.8
Ningbo	117.0	138.6	110.8	128.1	124.7
Hefei	120.7	146.4	123.1	116.6	126.9
Fuzhou	123.4	134.9	108.5	134.0	127.7
Xiamen	120.4	135.8	109.3	106.0	106.7
Nanchang	127.0	146.5	107.4	105.9	112.6
Jinan	125.7	148.3	117.2	129.8	119.3
Qingdao	126.2	139.4	103.7	162.1	116.7
Zhengzhou	119.4	147.7	114.0	105.0	117.6
Wuhan	125.3	150.5	108.9	112.3	116.7
Changsha	121.3	140.6	104.0	122.5	132.3
Guangzhou	114.2	125.0	105.6	130.7	115.4
Shenzhen	114.9	118.7	115.1	125.4	135.7
Nanning	125.7	148.1	122.5	124.6	109.6
Haikou	121.0	134.0	107.4	110.3	121.5
Chengdu	134.3	155.2	123.9	167.1	126.3
Chongqing	127.8	151.3	111.9	120.7	113.9
Guiyang	117.6	117.6	108.0	114.4	103.9
Kunming	112.6	128.4	112.8	106.6	121.1
Xian	131.2	159.4	115.4	130.5	129.5
Lanzhou	123.7	139.8	114.0	128.1	119.1
Xining	127.6	145.0	111.3	135.8	119.4
Yinchuan	121.8	150.7	106.5	131.9	115.0
Urumqi	125.6	143.8	112.8	117.8	124.6

	Parmaceutical and Medical Articles	Cosmetics	Books, Newspapers, and Magazines	Cultural and Recreational Articles	Daily Use Articles
Average Index	109.3	117.7	133.6	107.7	111.0
Beijing	109.6	111.2	145.1	107.0	111.5
Tianjin	120.2	105.8	149.1	113.5	108.8
Shijiazhuang	107.3	144.5	117.0	125.9	116.3
Taiyuan	101.2	128.1	154.0	106.6	116.0
Hohhot	110.0	129.0	147.9	106.5	110.3
Shenyang	108.6	131.8	135.0	106.4	118.1
Dalian	109.9	128.5	133.7	115.8	108.9
Changchun	112.5	109.7	126.1	108.4	106.6
Harbin	111.4	121.6	128.1	109.5	110.0
Shanghai	112.0	104.5	134.3	106.2	119.7
Nanjiing	108.2	107.9	131.8	109.5	123.0
Hangzhou	105.2	126.6	104.4	116.2	116.0
Ningbo	107.4	130.1	136.4	104.7	100.6
Hefei	120.3	106.4	154.5	102.6	105.4
Fuzhou	109.9	134.0	137.3	104.3	107.2
Xiamen	101.9	108.0	145.1	105.1	112.7
Nanchang	115.7	116.2	136.2	109.3	107.7
Jinan	110.2	113.4	120.7	98.1	105.1
Qingdao	107.0	107.3	147.4	102.4	99.9
Zhengzhou	99.3	108.8	138.7	103.7	104.5
Wuhan	111.6	121.3	129.9	117.2	116.9
Changsha	105.2	118.3	132.6	107.0	107.5
Guangzhou	111.8	105.8	153.4	100.3	115.7
Shenzhen	113.4	123.8	130.5	103.6	112.6
Nanning	106.8	117.9	153.2	109.1	112.5
Haikou	100.1	135.9	139.8	106.4	114.4
Chengdu	113.1	101.0	125.1	101.4	105.0
Chongqing	104.7	105.1	126.7	102.0	104.3
Guiyang	117.9	106.5	134.3	104.2	111.3
Kunming	96.5	114.0	127.6	96.2	110.7
Xian	121.2	131.3	121.7	114.6	112.2
Lanzhou	106.3	116.0	108.7	105.9	109.6
Xining	117.3	109.9	116.0	115.2	116.6
Yinchuan	101.7	117.7	121.1	101.3	105.1
Urumqi	132.8	123.6	134.3	111.0	116.8

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	Family Electrical Apparatus	Jewelry	Fuels	Building Decoration Materials	Machine and Electrical Products
Average Index	103.1	103.4	113.0	101.4	96.8
Beijing	104.8	103.9	95.9	109.7	95.1
Tianjin	100.4	101.4	102.3	100.6	101.9
Shijiazhuang	109.6	111.3	183.6	98.3	104.1
Taiyuan	105.6	107.6	115.5	100.3	87.6
Hohhot	103.7	99.3	100.8	95.2	98.9
Shenyang	101.6	107.2	129.5	101.1	99.6
Dalian	103.4	100.4	99.1	88.4	93.3
Changchun	100.6	105.2	135.1	104.2	97.1
Harbin	99.7	99.9	105.8	101.0	94.9
Shanghai	99.1	104.4	131.4	101.0	98.7
Nanjiing	97.1	107.2	97.1	101.6	93.7
Hangzhou	104.6	103.6	100.9	103.8	96.6
Ningbo	96.1	108.3	103.3	99.1	89.1
Hefei	107.0	107.7	137.5	97.9	96.4
Fuzhou	103.4	102.1	130.2	114.4	97.3
Xiamen	104.4	98.5	123.7	101.1	97.6
Nanchang	113.7	101.1	98.8	128.3	94.2
Jinan	101.9	101.5	105.7	116.9	102.8
Qingdao	99.2	103.3	127.4	106.5	94.9
Zhengzhou	99.3	103.3	107.2	104.6	103.2
Wuhan	105.6	102.2	96.2	90.4	91.9
Changsha	104.1	105.1	94.4	102.4	95.0
Guangzhou	96.7	106.1	117.1	98.3	94.8
Shenzhen	101.4	99.3	113.4	105.8	104.7
Nanning	100.4	101.0	98.7	98.4	95.8
Haikou	104.9	98.9	121.0	79.2	104.6
Chengdu	100.6	103.1	86.0	104.7	89.6
Chongqing	100.3	103.3	119.5	101.0	90.0
Guiyang	102.1	105.4	109.2	100.3	102.8
Kunming	101.9	104.5	89.6	92.3	95.4
Xian	111.0	103.0	117.7	102.5	87.5
Lanzhou	105.5	100.6	111.7	99.3	100.4
Xining	107.2	100.2	105.3	104.0	105.1
Yinchuan	103.6	104.3	99.1	101.6	89.6
Urumqi	112.6	105.3	143.4	96.3	97.7

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